UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

Refer to:
2004/00238 (Rivergate)
2004/00423 (Toyota Terminal 4)

July 14, 2004

Mr. Lawrence C. Evans
U.S. Army Corps of Engineers
Attn: Judy Linton
Regulatory Branch, CENWP-OP-G
P.O. Box 2946
Portland, Oregon 97208-2946

Re: Reinitiation of Endangered Species Act Formal Section 7 Consultation and Conference and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for Invasive Species Management at the Port of Portland Rivergate Enhancement Area and the Toyota Facility at Terminal 4, Multnomah County, Oregon. (Corps Nos.: 200100247 and 200100553)

Dear Mr. Evans:

The enclosed document contains a biological and conference opinion (Opinion) prepared by NOAA's National Marine Fisheries Service (NOAA Fisheries) pursuant to section 7(a)(2) of the Endangered Species Act (ESA) on the effects of reissuing Department of the Army Permits 200100247 and 200100553 to the Port of Portland (Port) to authorize an Invasive Weed Management Program at the Port of Portland's Rivergate Enhancement Area and Toyota Facility at Terminal 4, in Multnomah County, Oregon.

In this Opinion, NOAA Fisheries concludes that the proposed action is not likely to jeopardize the continued existence of Snake River (SR) sockeye salmon (*Oncorhynchus nerka*), SR fall Chinook salmon (*O. tshawytscha*), SR spring/summer Chinook salmon, Upper Columbia River (UCR) spring-run Chinook salmon, Lower Columbia River (LCR) Chinook salmon, Upper Willamette River (UWR) Chinook salmon, Columbia River chum salmon (*O. keta*), SR steelhead (*O. mykiss*), UCR steelhead, Middle Columbia River steelhead, UWR steelhead, LCR steelhead, or LCR coho salmon, (*Onchorynchus kisutch*), a species proposed for listing as threatened under the ESA, or destroy or adversely modify designated critical habitat.

The Opinion also includes an incidental take statement with terms and conditions necessary to minimize the impact of taking that is reasonably likely to be caused by this action. Take from actions by the action agency and applicant, if any, that meet these terms and conditions will be exempt from the ESA take prohibition. This incidental take statement does not become effective for LCR coho salmon until NOAA Fisheries adopts this conference opinion as a biological opinion, after the listing is final. Until the time this species is listed, the prohibitions of the ESA do not apply.

This document also includes the results of our consultation on the action's likely effects on essential fish habitats (EFH) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), and includes conservation recommendations to avoid, minimize, or otherwise offset potential adverse effects to EFH. Section 305(b)(4)(B) of the MSA requires Federal agencies to provide a detailed written response to NOAA Fisheries within 30-days after receiving these recommendations. If the response is inconsistent with the recommendations, the U. S. Army Corps of Engineers (Corps) must explain why the recommendations will not be followed, including the justification for any disagreements over the effects of the action and the recommendations.

Please direct any questions regarding this consultation to Dan Gambetta in the Oregon State Habitat Office at 503.231.2243.

Sincerely,

for Michael R Crouse

D. Robert Lohn
Regional Administrator

cc: Gerry Meyer, Port of Portland
Denise Rennis, Port of Portland

Endangered Species Act - Section 7 Consultation
Biological Opinion and Conference Opinion

&

Magnuson-Stevens Fishery Conservation and Management Act
Essential Fish Habitat Consultation

Reinitiation of Consultation for
Invasive Species Management at the Port of Portland Rivergate Enhancement Area
and Toyota Facility at Terminal 4,
Multnomah County, Oregon
(Corps Nos.: 200100247, 200100553)

Agency:	Army Corps of Engineers, Portland District
Consultation Conducted By:	NOAA's National Marine Fisheries Service, Northwest Region
Date Issued:	July 14, 2004
Issued by:	for Michael R Crouse D. Robert Lohn Regional Administrator
Refer to:	**2004/00238 (Rivergate)** **2004/00423 (Toyota Terminal 4)**

TABLE OF CONTENTS

1. INTRODUCTION 1
   1.1 Background 1
   1.2 Proposed Action 2
   1.3 Action Area 4

2. ENDANGERED SPECIES ACT 7
   2.1 Biological Opinion 7
      2.1.1 Biological Requirements 7
      2.1.2 Status of the ESUs 8
      2.1.3 Environmental Baseline 14
      2.1.4 Analysis of Effects 18
         2.1.4.1 Adjuvants 19
         2.1.4.2 Glyphosate 21
         2.1.4.3 Triclopyr 23
         2.1.4.4 Vectors of Exposure 26
         2.1.4.5 Direct Effects of Proposed Action 28
         2.1.4.6 Indirect Effects of Proposed Action 29
      2.1.5 Cumulative Effects 31
      2.1.6 Conclusion 32
      2.1.7 Conservation Recommendations 33
      2.1.8 Reinitiation of Consultation 34
   2.2 Incidental Take Statement 34
      2.2.1 Amount or Extent of Take 34
      2.2.2 Reasonable and Prudent Measures 35
      2.2.3 Terms and Conditions 35

3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT . . 37
   3.1 Background 37
   3.2 Identification of EFH 38
   3.3 Proposed Actions 39
   3.4 Effects of Proposed Action 39
   3.5 Conclusion 39
   3.6 EFH Conservation Recommendations 39
   3.7 Statutory Response Requirement 39
   3.8 Supplemental Consultation 39

4. LITERATURE CITED 40

1. INTRODUCTION

The biological and conference opinion (Opinion) and incidental take statement of this consultation were prepared by NOAA Fisheries in accordance with section 7(a)(2) the Endangered Species Act (ESA) of 1973, as amended (16 USC 1531 *et seq.*), and implementing regulations at 50 CFR 402. The essential fish habitat (EFH) part of this consultation was prepared in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 USC 1801 *et seq.*) and implementing regulations at 50 CFR 600. The administrative record for this consultation is on file at the NOAA Fisheries, Oregon State Habitat Branch, Portland, Oregon.

1.1 Background

On July 9, 2002, the Corps issued permit 200100553 to the Port for reconfiguration of the existing Toyota facility at Terminal 4. This permit action fell under the *15 Categories of Activities Requiring Department of the Army Permits* programmatic biological opinion (NOAA Fisheries No.: 2001/00178), issued March 21, 2001.

On July 30, 2001, NOAA Fisheries received a letter from the Corps requesting informal consultation on the issuance of a permit to the Port for a proposed mitigation project (Phase I) in the Rivergate Industrial Area. NOAA Fisheries responded with a letter dated August 28, 2001, indicating that they did not concur with the finding of "not likely to adversely affect" and recommended formal consultation. Based on adequate information received from the Corps, NOAA Fisheries prepared a biological opinion issued on December 17, 2001, that concluded that the proposed action was not likely to jeopardize the continued existence of ESA listed salmonids (NOAA Fisheries No.: 2001/00947).

On July 9, 2002, NOAA Fisheries received a letter dated May 15, 2002, from the Corps requesting formal consultation on the issuance of a permit to the Port for a proposed mitigation project (Phase II) in the Rivergate Industrial Area. Based on adequate information received from the Corps, NOAA Fisheries prepared a biological opinion issued on August 23, 2002, that concluded that the proposed action was not likely to jeopardize the continued existence of ESA listed salmonids (NOAA Fisheries No.: 2002/00772).

Manual control of invasive plants has been attempted at the Rivergate site for two growing seasons, 2002 and 2003, without the use of herbicides. These efforts have been met with limited success and the Port is now requesting the use of the herbicides Rodeo® (glyphosate) and Garlon® 3A (triclopyr) along with an adjuvant LI-700 or Agri-Dex, for invasive species management.

Both Corps-issued permits included a condition that disallowed the use of herbicides within 300 feet of any stream channel. The use of the herbicides Rodeo® and Garlon® 3A along with an adjuvant LI-700 or Agri-Dex, will occur directly within the riparian zone of the Columbia River Slough and the Lower Willamette River. Consequently, the Corps requested reinitiation of consultation for these two projects to include the use of herbicides for invasive species management.

NOAA Fisheries received a letter from the Corps requesting reinitiation of formal consultation on March 8, 2004. A biological assessment (BA) describing the proposed action and its potential effects was submitted with the letter. NOAA Fisheries considered the information sufficient to reinitiate formal consultation.

In the BA, the Port determined the proposed action was not likely to adversely affect Snake River (SR) sockeye salmon (*Oncorhynchus nerka*), SR spring/summer Chinook salmon (*O. tshawytscha*), SR fall Chinook salmon, Lower Columbia River (LCR) steelhead (*O. mykiss*), Upper Columbia River (UCR) steelhead, SR steelhead, Middle Columbia River (MCR) steelhead, Columbia River (CR) chum salmon (*O. keta*), LCR Chinook salmon, UCR spring-run Chinook salmon, Upper Willamette River (UWR) steelhead and UWR Chinook salmon may occur within the project area.

The objective of this Opinion is to determine whether issuing a permit to apply the herbicides Rodeo® and Garlon® 3A along with an adjuvant LI-700 or Agri-Dex, for invasive species management is likely to jeopardize the continued existence of the above listed species or destroy or adversely modify critical habitat.

The objective of the EFH consultation is to determine whether the proposed action may adversely affect the habitat for Chinook or coho salmon and starry flounder (*Platyichthys stellatus*), and to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse effects to EFH resulting from the proposed action.

1.2 Proposed Action

For purposes of this consultation, the proposed action is reissuing Department of the Army Permits 200100247 and 200100553 to the Port to authorize an Invasive Weed Management Program at the Port of Portland's Rivergate Enhancement Area and the Toyota Facility at Terminal 4, in Multnomah County, Oregon.

The Port proposes to use herbicides to control and eradicate recurring invasive plant species on two of their properties to establish the native recruitment of desirable species. Once the desirable species are established, they will outcompete invasive weeds and cut down on maintenance needs.

The first property is the Rivergate Enhancement Area. The Rivergate Enhancement Area is 35 acres, and the proposed action involves approximately 3 to 5 acres within wetland, upland, and riparian buffer habitats along the Colombia Slough near the confluence of the Willamette River in Portland, Oregon. The 18-mile slough parallels the Columbia River, flowing west from Fairview Lake near Gresham, to its confluence with the Willamette River. The areas within the Rivergate Enhancement Area where the Port will apply herbicides are Leadbetter Peninsula, North Slough behind the bank, South Slough behind the bank, and Ramsey Lake. All areas of application are a minimum of 25 feet from the closest fish-bearing stream, with the exception of the Leadbetter Peninsula, which, at high water, has a direct connection with Bybee Lake.

The second property is the Toyota Facility at Terminal 4 (Toyota T-4). Applications at the Toyota T-4 site involve the reconstructed riverbank, which includes native riparian habitat along the lower bank slope, native plantings within the stormwater swale in the mid-bank area, and native upland habitat along the upper portion of the swale. All of these areas of application are along the riparian zone of the Willamette River in Portland, Oregon.

Enhancement of the Rivergate and Toyota T-4 areas will occur by actively working to remove invasive, non-native plants, including Himalayan blackberry, reed canarygrass, and other non-native pasture weeds and grasses. This will reduce competition with native species to facilitate natural plant recruitment, and prepare areas for active re-vegetation with native species.

The non-native plants will then be treated with Rodeo® or Garlon® 3A using a backpack sprayer or wicking methods, and pulled and cut using manual and mechanical control methods. Herbicides will be used in strict accordance with the guidelines set forth under label requirements.

The Port plans to use the systemic herbicides Rodeo® and Garlon® 3A. The use of a non-ionic surfactant, either LI-700 or Agri-Dex, is required for use with Rodeo® to promote effectiveness by helping chemicals adhere to the plants, act as a penetrant, act as an anti-foaming agent, and to retard drip and drift. These chemicals are diluted to between 0.5% and 1.5% when mixed with undiluted herbicide. The herbicides themselves will be diluted to between 1% and 2% (1.5% in most cases) when mixed with water.

Approximately 0.4 pounds (lbs) of active ingredient per acre, per application will be applied. This translates to an amount of 3.7 gallons of herbicide solution of Rodeo® (after 2% dilution) per acre, per application, and 6.6 gallons of herbicide solution of Garlon® (after 2% dilution) per acre, per application.

Herbicide applications will take place during the growing season three times per year for the next 4 years; covering the duration of the existing permit. An early spring application will occur during March/April to target over-wintered plants. An early summer application will occur in June/July to target new seasonal growth. A fall application will occur in September to target plants that translocate into their root systems. In addition, some limited spot or wick spraying may take place outside of these application timeframes to target new growth or target species that were missed during main application.

The following is a summary of conservation measures that will be followed, as described in the BA.

1. Herbicide products will be limited to Rodeo® and Garlon®, with the surfactants LI-700 or Agri-Dex being used to help the chemicals adhere to plants and prevent drip and drift.
2. Garlon® will not be applied to wetland sites or within 25 feet of waterbodies, only upland site to control upland broadleaf plants and blackberry. Rodeo® will only be applied to sites with close proximity to water, and wetlands.
3. All contractors will be licensed applicators and will provide records to Port staff.
4. Herbicides will be applied only using a spot-spray method with a hand wand from low pressure backpack sprayer to minimize drift.
5. Solutions will be low in herbicide concentration (between 1% and 2% herbicide mixed with water).
6. Spraying will not take place if winds exceed 5 mph, or if the wind direction will carry drift into open water, or if precipitation has been forecasted within 24 hours of spraying.
7. Backpack sprayers will utilize a low pressure sprayer with a 0.5 gallons per minute (gpm) nozzle to minimize drift.
8. Plants will be sprayed at the optimum height (approximately 18 to 42 inches) to allow for adequate leaf surface, ease of application, minimization of drift, and minimization of drip.
9. There will be no more than three main applications a year, with limited spot or wick spraying taking place outside these main application times.

1.3 Action Area

'Action area' means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). For purposes of this consultation, the action area includes the receiving waterways from the areas of herbicide application within the Port's Rivergate Industrial Enhancement Area and Toytota T-4 facility. Areas of application include a section of approximately 1,800 feet of the north and south banks of the Columbia Slough and adjacent uplands, approximately 2,700 feet of the entire south bank of the Columbia Slough beside Ramsey Lake, the Leadbetter Peninsula at Bybee Lake, and over 1 mile of the eastern riverbank of the Willamette River. The receiving waterways from these areas of application include Bybee Lake, the Columbia Slough from the confluence with the Willamette River upstream for approximately 3 miles, and the entire Willamette River downstream from the Toyota T-4 facility to the confluence with the Columbia River. This is based on the persistence of chemical residues and degradates in the water column which are expected to be diluted to neglible concentrations upon reaching the Columbia River.

The Willamette River and Columbia Slough serve as a migration area for all listed species under consideration in this Opinion. It may also serve as a feeding and rearing area for juvenile chum and sub-yearling Chinook salmon. Essential features of the area for the species are: (1) Substrate, (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food (juvenile only), (8) riparian vegetation, (9) space, and (10) safe passage conditions (50 CFR 226). The proposed action may affect the essential habitat features of water quality (herbicide concentrations), cover/shelter, riparian vegetation, and food.

References for further background on listing status, biological information and critical habitat elements can be found in Table 1. None of the action area is within designated critical habitat for any of the species under consideration in this Opinion.

Table 1. Federal Register Notices for Final Rules that list species, designate critical habitat, or apply protective regulations to evolutionarily significant untils (ESUs) considered in this consultation. (Listing status 'T' means listed as threatened under the ESA, 'E' means listed as endangered, and 'P' means proposed for listing; see, also, proposed listing determinations for 27 ESUs of West Coast salmonids, at 69 FR 33102, 6/14/04.)

Species ESU	**Listing Status**	**Critical Habitat**	**Protective Regulations**
Chinook salmon (*Oncorhynchus Tshawytscha*)			
Lower Columbia River	T 3/24/99; 64 FR 14308	Not applicable	7/10/00; 65 FR 42422
Upper Willamette River	T 3/24/99; 64 FR 14308	Not applicable	7/10/00; 65 FR 42422
Upper Columbia River spring-run	E 3/27/99; 64 FR 14308	Not applicable	ESA section 9 applies
Snake River spring / summer run	T 4/22/92; 57 FR 14653	10/25/99; 64 FR 57399	7/10/00; 65 FR 42422
Snake River fall-run	T 6/3/92; 57 FR 23458	12/28/93; 58 FR 68543	7/10/00; 65 FR 42422
Chum salmon (*O. keta*)			
Columbia River	T 3/25/99; 64 FR 14508	Not applicable	7/10/00; 65 FR 42422
Coho salmon (*O. kisutch*)			
Lower Columbia River	P 6/14/04; 69 FR 33102	Not applicable	Not applicable
Sockeye salmon (*O. nerka*)			
Snake River	E 11/20/91; 56 FR 58619	12/28/93; 58 FR 68543	ESA section 9 applies
Steelhead (*O. mykiss*)			
Lower Columbia River	T 3/19/98; 63 FR 13347	Not applicable	7/10/00; 65 FR 42422
Upper Willamette River	T 3/25/99; 64 FR 14517	Not applicable	7/10/00; 65 FR 42422
Middle Columbia River	T 3/25/99; 64 FR 14517	Not applicable	7/10/00; 65 FR 42422
Upper Columbia River	E 8/18/97; 62 FR 43937	Not applicable	ESA section 9 applies
Snake River Basin	T 8/18/97; 62 FR 43937	Not applicable	7/10/00; 65 FR 42422

2. ENDANGERED SPECIES ACT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat on which they depend. Section 7(a)(2) of the ESA requires Federal agencies to consult with U.S. Fish and Wildlife Service and NOAA's National Marine Fisheries Service (NOAA Fisheries), as appropriate, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or adversely modify or destroy their critical habitats.

Section 9(a)(1) and protective regulations adopted pursuant to section 4(d) of the ESA prohibit the 'taking' of listed species without a specific permit or exemption. Among other things, an action that harasses, wounds, or kills an individual of a listed species or harms a species by altering habitat in a way that significantly impairs its essential behavioral patterns is a taking (50 CFR 222.102). 'Incidental take' refers to takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(o)(2) exempts any taking in compliance with the terms and conditions of a written incidental take statement from the taking prohibition.

2.1 Biological Opinion

This Opinion presents NOAA Fisheries' review of the status of each evolutionarily significant unit (ESU)[1] considered in this consultation and critical habitat, the environmental baseline for the action area, all the effects of the action as proposed, and cumulative effects. NOAA Fisheries analyzes those combined factors to conclude whether the proposed action is likely to appreciably reduce the likelihood of both the survival and recovery of the affected ESUs, or is likely to destroy or adversely modify critical habitat. See, 50 CFR 402.14(g). If the action under consultation is likely to jeopardize an ESU, or destroy or adversely modify critical habitat, NOAA Fisheries must identify any reasonable and prudent alternatives for the action that avoid jeopardy or destruction or adverse modification of critical habitat and meet other regulatory requirements (50 CFR 402.02).

2.1.1 Biological Requirements

The first step in the methods NOAA Fisheries uses for applying the ESA section 7(a)(2) to listed salmon is to define the species' biological requirements that are most relevant to each consultation. NOAA Fisheries also considers the current status of the listed species, taking into account population size, trends, distribution and genetic diversity. To assess the current status of the listed species, NOAA Fisheries starts with the determinations made in its decision to list the

[1] 'ESU' means an anadromous salmon or steelhead population that is either listed or being considered for listing under the ESA, is substantially isolated reproductively from conspecific populations, and represents an important component of the evolutionary legacy of the species (Waples 1991). An ESU may include portions or combinations of populations more commonly defined as stocks within or across regions.

species for ESA protection and also considers new data available that is relevant to the determination.

The relevant biological requirements are those necessary for the listed species to survive and recover to naturally-reproducing population levels, at which time protection under the ESA would become unnecessary. Adequate population levels must safeguard the genetic diversity of the listed stock, enhance their capacity to adapt to various environmental conditions, and allow them to become self-sustaining in the natural environment.

For this consultation, the biological requirements are improved habitat characteristics that function to support successful adult and juvenile migration and rearing. The survival of ESA-listed Pacific salmonids in the wild depends upon the proper functioning of certain ecosystem processes, including habitat formation and maintenance. Restoring functional habitats depends largely on allowing natural processes to increase their ecological function, while removing adverse impacts of current practices. The current status of the listed species covered by this Opinion, based on their risk of extinction, has not significantly improved since they were considered for listing (BRT 2003).

2.1.2 Status of the ESUs

This section defines range-wide biological requirements of each ESU, and reviews the status of the ESUs relative to those requirements. The present risk faced by each ESU informs NOAA Fisheries' determination of whether additional risk will 'appreciably reduce' the likelihood that an ESU will survive and recover in the wild. The greater the present risk, the more likely any additional risk resulting from the proposed action's effects on the population size, productivity (growth rate), distribution, or genetic diversity of the ESU will be an appreciable reduction (see, McElhaney *et al.* 2000).

According to a recent draft of "Preliminary conclusions regarding the updated status of listed ESUs of West Coast salmon and steelhead," drafted by the West Coast Salmon Biological Review Team (BRT), a number of ESUs are "likely to become endangered in the foreseeable future"(NOAA Fisheries 2003). Preliminary conclusions for each listed ESU considered in this Opinion are discussed below.

<u>LCR Coho</u>
The status of this ESU was reviewed by the BRT only a year ago, so relatively little new information was available. A majority of the likelihood votes for Lower Columbia River coho fell in the "danger of extinction" category, with the remainder falling in the "likely to become endangered" category. As indicated by the risk matrix totals, the BRT had major concerns for this ESU in all risk categories (mean scores ranged from 4.3 for growth rate/productivity to 4.8 for spatial structure/connectivity). The most serious overall concern was the nearly total absence of naturally-produced spawners throughout the ESU, with the attendant risks associated with small population, loss of diversity, and fragmentation and isolation of the remaining naturally-produced fish. In the only two populations with significant natural production (Sandy and

Clackamas), short- and long-term trends are negative and productivity (as gauged by preharvest recruits) is down sharply from recent (1980s) levels. On the positive side, adult returns in 2000 and 2001 were up noticeably in some areas.

The paucity of naturally-produced spawners in this ESU can be contrasted with the very large number of hatchery-produced adults. Although the scale of the hatchery programs (and the great disparity in relative numbers of hatchery and wild fish), produce many genetic and ecological threats to the natural populations, collectively these hatchery populations contain a great deal of genetic resources that might be tapped to help promote restoration of more widespread naturally-spawning populations.

LCR Chinook

Natural-origin fish had parents that spawned in the wild as opposed to hatchery-origin fish whose parents were spawned in a hatchery. The abundance of natural-origin spawners ranges from completely extirpated for most of the spring-run populations, to over 6,500 for the Lewis River bright population. The majority of the fall-run tule populations have a substantial fraction of hatchery-origin spawners in the spawning areas and are hypothesized to be sustained largely by hatchery production. Exceptions are the Coweeman and Sandy River fall-run populations which have few hatchery fish spawning on the natural spawning areas. These populations have recent mean abundance estimates of 348 and 183 spawners, respectively. The majority of the spring-run populations have been extirpated largely as the result of dams blocking access to their high elevation habitat. The two bright Chinook populations (*i.e.* Lewis and Sandy) have relatively high abundances, particularly the Lewis.

In many cases, data were not available to distinguish between natural- and hatchery-origin spawners, so only total spawner (or dam count) information is presented. This type of figure can give a sense of the levels of abundance, overall trend, patterns of variability, and the fraction of hatchery-origin spawners. A high fraction of hatchery-origin spawners indicates that the population may potentially be sustained by hatchery production and not the natural environment. It is important to note that estimates of the fraction of hatchery-origin fish are highly uncertain since the hatchery marking rate for LCR fall Chinook is generally only a few percent and expansion to population hatchery fraction is based on only a handful of recovered marked fish.

LCR Steelhead

Based on the updated information provided in this report, the information contained in previous LCR status reviews, and preliminary analyses, the number of historical and currently viable populations have been tentatively identified. This summary indicates some of the uncertainty about this ESU. Like the previous BRT, the current BRT could not conclusively identify a single population that is naturally self-sustaining. Over the period of the available time series, most of the populations are in decline and are at relatively low abundance (no population has recent mean greater than 750 spawners). In addition, many of the populations continue to have a substantial fraction of hatchery-origin spawners and may not be naturally self-sustaining.

CR Chum

A majority of the BRT votes for this ESU fell in the “likely to become endangered” category, with a minority falling in the “danger of extinction” category. Most or all of the risk factors identified previously by the BRT remain important concerns. The Technical Recovery Team (TRT) has estimated that close to 90% of the historic populations in the ESU are extinct or nearly so, resulting in loss of much diversity and connectivity between populations. The populations that remain are small, and overall abundance for the ESU is low. This ESU has showed low productivity for many decades, even though the remaining populations are at low abundance and density-dependent compensation might be expected. The BRT was encouraged that unofficial reports for 2002 suggest a large increase in abundance in some (perhaps many) locations. Whether this large increase is due to any recent management actions or simply reflects unusually good conditions in the marine environment is not known at this time, but the result is encouraging, particularly if it were to be sustained for a number of years.

UCR Spring Chinook

There are no estimates of historical abundance specific to this ESU before the 1930s. The drainages supporting this ESU are all above Rock Island Dam on the upper Columbia River. Rock Island Dam is the oldest major hydroelectric project on the Columbia River, beginning operations in 1933. Counts of returning Chinook have been made since the 1930s. Annual estimates of the aggregate return of spring Chinook to the Upper Columbia River are derived from the dam counts based on the nadir between spring and summer return peaks. Spring Chinook salmon spawn in three major drainages above Rock Island Dam: Wenatchee, Methow and Entiat Rivers. Historically, spring Chinook may have also used portions of the Okanogan River.

Grand Coulee Dam, completed in 1938, formed an impassable block to the upstream migration of anadromous fish. Chief Joseph Dam was constructed on the mainstem Columbia River downstream from Grand Coulee Dam and is also a block to anadromous fish. There are no specific estimates of historical production of spring Chinook from mainstem tributaries above Grand Coulee Dam. Habitat typical of that used by spring Chinook salmon in accessible portions of the Columbia River basin is found in the middle to upper reaches of mainstem tributaries above Grand Coulee Dam. It is likely that the historical range of this ESU included these areas.

MCR Steelhead

The MCR steelhead ESU includes steelhead populations in Oregon and Washington drainages upstream of the Hood River and Wind River systems, to and including the Yakima River. The Snake River is not included in this ESU. Major drainages in this ESU are the Deschutes, John Day, Umatilla, Walla-Walla, Yakima, and Klickitat River systems. Almost all steelhead populations within this ESU are summer-run fish, the exceptions being winter-run components returning to the Klickitat and Fifteen Mile Creek watersheds. Most of the populations within this ESU are characterized by a balance between 1- and 2-year-old smolt outmigrants. Adults return after 1 or 2 years at sea.

Hatchery facilities are in a number of drainages within the geographic area of this ESU, although there are also subbasins with little or no direct hatchery influence. The John Day River system is a large river basin supporting an estimated five steelhead populations. The basin has not been outplanted with hatchery steelhead, and out-of-basin straying is believed to be low. The Yakima River system includes 4 to 5 populations. Hatchery production in the basin was relatively limited historically, and was phased out in the early 1990s. The Umatilla, the Walla Walla, and the Deschutes River systems each have ongoing hatchery production programs based on locally-derived broodstocks. Straying from out-of-basin production programs into the Deschutes River is identified as a chronic occurrence.

Blockages have prevented access to sizable steelhead production areas in the Deschutes River and the White Salmon River. In the Deschutes River, Pelton Dam blocks access to upstream habitat historically used by steelhead. Condit Dam, constructed in 1913, blocked access to all but 2 to 3 miles of habitat suitable for steelhead production in the Big White Salmon River (Rawding 2001). Substantial populations of resident trout exist in both areas.

<u>UCR Steelhead</u>
The life-history patterns of UCR steelhead are complex. Adults return to the Columbia River in the late summer and early fall, most migrating relatively quickly up the mainstem to their natal tributaries. A portion of the returning run overwinters in the mainstem reservoirs, passing over the upper and mid-Columbia River dams in April and May of the following year. Spawning occurs in the late spring following entry into the river. Juvenile steelhead spend 1 to 7 years rearing in freshwater before migrating to the ocean. Smolt outmigrations are predominately age 2 and age 3 juveniles. Most adult steelhead return after 1 or 2 years at sea, starting the cycle again.

Harvest rates on upper river steelhead have been substantially cut back from historical levels. Direct commercial harvest of steelhead in non-Indian fisheries was eliminated by legislation in the early 1970s. Incidental impacts in fisheries directed at other species continued in the lower river, but at substantially reduced levels. In 1985, steelhead recreational fisheries in this region (and in other Washington tributaries) were changed to mandate release of wild fish.

Hatchery returns predominate the estimated escapement in the Wenatchee, Methow, and Okanogan River drainages. The effectiveness of hatchery spawners relative to their natural counterparts is a major uncertainty for both populations. While the return timing into the Columbia River is similar for both wild and hatchery steelhead returning to the Upper Columbia, the spawning timing in the hatchery is accelerated. The long-term effects of such acceleration on the spawning timing of returning hatchery-produced adults in nature is not known. We have no direct information on the relative fitness of Upper Columbia progeny with at least one parent of hatchery origin.

<u>UWR Steelhead</u>
Populations of UWR steelhead are at relatively low abundance, and overall abundance of the ESU has been steeply declining since 1988, with adult returns improving in 2001 and 2002

(NOAA Fisheries 2003). It is uncertain whether the recent increases can be sustained. The previous BRT was concerned about the potential negative interaction between non-native summer steelhead and wild winter steelhead (cited in NOAA Fisheries 2003). The loss of access to historical spawning grounds because of dams was considered a major risk factor.

<u>SR Spring/Summer Chinook</u>
This ESU includes production areas that are characterized by spring-timed returns, summer-timed returns, and combinations from the two adult timing patterns. Runs classified as spring Chinook are counted at Bonneville Dam from early March and to the first week of June, while runs classified as summer Chinook return to the Columbia River from June through August. Returning fish hold in deep mainstem and tributary pools until late summer, when they emigrate up into tributary areas and spawn. In general, spring-run Chinook tend to spawn in higher elevation reaches of major Snake River tributaries in mid- through late August, while summer-run SR Chinook spawn approximately 1 month later than spring-run fish.

Spring and summer Chinook from the Snake River basin exhibit stream type life history characteristics (Healey 1983). Eggs are deposited in late summer and early fall, incubate over the following winter, and hatch in late winter and early spring of the following year. Juveniles rear through the summer, overwinter, and migrate to sea in the spring of their second year of life. Depending on the tributary and the specific habitat conditions, juveniles may migrate extensively from natal reaches into alternative summer rearing and/or overwintering areas. SR spring/summer Chinook return from the ocean to spawn primarily as 4 and 5 year-old fish, after 2 to 3 years in the ocean. A small fraction of the fish return as 3-year-old ‘jacks’, heavily predominated by males.

<u>SR Fall Chinook</u>
SR fall Chinook spawn above Lower Granite Dam in the mainstem Snake River and in the lower reaches of major tributaries entering below Hells Canyon Dam. Adult fall Chinook enter the Columbia River in July and August. The Snake River component of the fall Chinook run migrates past the Lower Snake River mainstem dams in September and October. Spawning occurs from October through November. Juveniles emerge from the gravels in March and April of the following year. S R fall Chinook are subyearling migrants, moving downstream from natal spawning and early rearing areas from June through early fall.

Fall Chinook returns to the Snake River generally declined through the first half of this century (Irving and Bjornn 1981). In spite of the declines, the Snake River basin remained the largest single natural production area for fall Chinook in the Columbia drainage into the early 1960s (Fulton 1968). Spawning and rearing habitat forSR fall Chinook was significantly reduced by the construction of a series of Snake River mainstem dams. Historically, the primary fall Chinook spawning areas were on the upper mainstem of the Snake River. Currently, natural spawning is limited to the area from the upper end of Lower Granite Reservoir to Hells Canyon dam and the lower reaches of the Imnaha, Grande Ronde, Clearwater, and Tucannon Rivers.

SR Steelhead

The Snake River steelhead ESU is distributed throughout the Snake River drainage system, including tributaries in southwest Washington, eastern Oregon and north/central Idaho (NMFS, 1996). SR steelhead migrate a substantial distance from the ocean (up to 1,500 kilometers) and use high elevation tributaries (typically 1,000 to 2,000 meters above sea level) for spawning and juvenile rearing. SR steelhead occupy habitat that is considerably warmer and drier (on an annual basis) than other steelhead ESUs. SR steelhead are generally classified as summer-run, based on their adult run timing patterns. Summer steelhead enter the Columbia River from late June to October. After holding over the winter, summer steelhead spawn during the following spring (March to May). Managers classify up-river summer steelhead runs into to groups based primarily on ocean age and adult size on their return to the Columbia River. A-run steelhead are predominately age-1 ocean fish, while B-run steelhead are larger and predominated by age-2 ocean fish. Most basins within the ESU, with the exception of the Middle Fork Salmon River, have some sort of artificial production.

UWR Chinook

All spring Chinook in the ESU, except those entering the Clackamas River, must pass Willamette Falls. There is no assessment of the ratio of hatchery-origin to wild-origin Chinook passing the falls, but the majority of fish are undoubtedly of hatchery origin. (Natural-origin fish are defined has having had parents that spawned in the wild, as opposed to hatchery-origin fish whose parents spawned in a hatchery.)

The updated information provided in the BRT (2003) report, the information contained in previous UWR chinook status reviews, and preliminary analysis by the Willamette Lower Columbia Technical Review Team, indicate that most natural spring chinook populations are likely extirpated or nearly so. The only population considered potentially self-sustaining is the McKenzie. However, its abundance has been relatively low (low thousands) with a substantial number of these fish being of hatchery origin. The population has shown a substantial increase in the last couple of years, hypothesized to be a result of increase ocean survival. It is unknown what ocean survivals will be in the future and the longterm sustainability of this population in uncertain.

A majority (70%) of the BRT votes for this ESU fell in the ‘likely to become endangered’ category, with minorities falling in the ‘danger of extinction’ and ‘not likely to become endangered’ categories. The BRT found moderately high risks in all VSP elements, with risk estimates ranging from moderate for growth rate/productivity to moderately high for spatial structure.

SR Sockeye

The first formal ESA status review for salmon in the Pacific Northwest was conducted in response to a 1990 petition to list sockeye salmon from Redfish Lake in Idaho as an endangered species. When pressed to make a decision regarding the ESU status of Redfish Lake sockeye salmon, the BRT concluded that, because they could not determine with any certainty that the original sockeye gene pool was extinct, they should assume that it did persist and was separate from the kokanee gene pool. This conclusion was strongly influenced by consideration of the irreversible consequences of making an error in the other direction (*i.e.*, if the species was not listed based on the assumption that kokanee and sockeye populations were a single gene pool and this later proved not to be the case, the species could easily go extinct before the error was detected).

2.1.3 Environmental Baseline

In step 2 of NOAA Fisheries' analysis, we evaluate the relevance of the environmental baseline in the action area to the species' current status. The environmental baseline is an analysis of the effects of past and ongoing human-caused and natural factors leading to the current status of the species or its habitat and ecosystem within the action area. Environmental baseline conditions within the action area were evaluated for the subject action at the project level and watershed scales. The current condition of instream, riparian, and watershed factors that collectively provide properly functioning aquatic habitat is essential for the survival and recovery of the species.

Pesticides in the Willamette Basin

The Willamette River basin is a highly productive agricultural valley. Economically important crops include, among others, grass seed, wheat and other grains, hops, row crops, berries, fruits, nuts, and nursery (Anderson *et al.* 1997).

Over 4.5 million lbs of pesticides are used each year in the Willamette River basin (Rinehold and Witt 1989, as cited in Wentz *et al.* 1998). Recent studies by the U.S. Geological Survey (USGS) had found over 50 different pesticides in both urban and rural streams throughout the Willamette River basin, indicating widespread contamination of the Willamette River and its tributaries (Wentz *et al.* 1998). Ten pesticides exceeded criteria established by the U.S. Environmental Protection Agency (EPA) for the protection of aquatic life from chronic toxicity. Of all the most frequently detected pesticides, the majority were herbicides. Atrazine, simazine, metolachlor, deethylatrazine, diuron, and diazinon were the compounds most commonly detected.

While general land use is known, details of pesticide, herbicide, and fertilizer application amounts are not well documented for the Willamette River basin. However, a summary of agricultural crops and associated pesticide use in the lower Willamette River basin from 1990 to 1996 is provided by Jenkins (1999)(Table 2).

Data from Table 2 has been used to identify some of the pesticides likely to be applied in the Lower Willamette River basin. Not enough is known of the fate and transport of these chemicals to make a reasonable assessment of how much pesticides are within the aquatic habitat. But it is clear that given the sheer quantity of pesticide applications, exposure to these chemicals to listed species is very likely. Furthermore, previous studies by the USGS confirmed that many different pesticides can be found in small Willamette Valley streams and are consistently making their way in to the aquatic environment, and degrading water quality. (Anderson *et al.*, 1997; Wentz *et al.* 1998).

The Willamette River

Terminal 4 is within the lower Willamette River at RM 4 within the Portland Harbor. The Willamette River watershed covers approximately 11,500 square miles in northwest Oregon between the Coast and Cascade Mountain ranges. The river travels 187 miles from its headwaters to its mouth at the Columbia River. Most of the rainfall occurs in the fall, winter, and spring, with little rainfall during June, July, and August. The lowest river flow occurs during late summer. The 13 Corps dams on tributary systems largely regulate flows in the mainstem Willamette River.

Significant changes have occurred in the watershed since the arrival of Europeans in the 1800s. The watershed was mostly forested land before the arrival of white settlers. Now, about half the basin is still forested. One-third of the basin is used for agriculture, and about 5% is urbanized or is in residential use. The river receives direct inputs from treated municipal wastes and industrial effluents. Nonpoint source input from agricultural, silvicultural, residential, urban and industrial land uses are also significant, especially during rainfall runoff.

The Willamette River, from its mouth to Willamette Falls, is on the 1998 Oregon Department of Environmental Quality (ODEQ) 303(d) list as water quality limited for the following parameters: Temperature (summer), bacteria, biological criteria (fish skeletal deformities), and toxics (mercury in fish tissue). Results from ODEQ ambient monitoring data that was collected during the summer indicate that 68% of the values at RM 7 and 61% of the values at RM 13.2 exceed the temperature standard of 68°C. Sediment conditions in the Willamette River watershed range from excellent in some of the upper tributaries to poor in much of the mainstem of the river (Altman *et al.* 1997). In the lower Willamette River, average turbidity levels tend to be higher in fall and winter. Monthly average turbidity ranges from 4 NTUs to 149 NTUs.

Table 2. Pesticide usage in the Lower Willamette basin (1990 to 1996)

TOTAL PLANTED ACRES: 93708

PESTICIDE COMPOUND	(lbs. a.i.)	PESTICIDE COMPOUND	(lbs. a.i.)	PESTICIDE COMPOUND	(lbs. a.i.)
1,3-DICHLOROPROPENE	10000	DIQUAT	32	MONOCARBAMIDE	858
2,4-D	2280	DISULFOTON	382	MYCLOBUTANIL	55
2,4-DB	264	DIURON	47268	NALED	6348
ACEPHATE	4350	DODEMORPH ACETATE	50	NAPROPAMIDE	15740
ALACHLOR	2271	DODINE	1342	NORFLURAZON	1621
ASULAM	28	ENDOSULFAN	4763	OIL	18859
ATRAZINE	7186	EPTC	20210	ORYZALIN	2720
AZINPHOS-METHYL	4273	ESFENVALERATE	402	OXADIAZON	4990
B. T.	3260	ETHALFLURALIN	90	OXYCARBOXIN	50
BACILLUS SUBTILLIS	24	ETHEPHON	137	OXYDEMETON-METHYL	1386
BENDIOCARB	1650	ETHOFUMESATE	316	OXYFLUORFEN	5347
BENEFIN	350	ETHOPROP	3640	OXYTHIOQUINOX	717
BENOMYL	5934	ETRIDAZOLE	135	PARAQUAT	8793
BENSULIDE	506	FENAMIPHOS	3108	PARATHION	20
BENTAZON	576	FENARIMOL	15	PCNB	520
BIFENTHRIN	3895	FENBUTATIN-OXIDE	3509	PENDIMETHALIN	2012
BORDEAUX	4523	FENPROPATHRIN	10	PERMETHRIN	1068
BROMINE	30	FENVALERATE	19	PHORATE	546
BROMOXYNIL	4408	FERBAM	786	PHOSMET	497
BUTYLATE	216	FLUVALINATE	12	PRONAMIDE	10318
CAPTAN	5074	FONOFOS	4935	PROPARGITE	1212
CARBARYL	3515	FORMETANATE HCl	35	PROPICONAZOLE	3384
CARBOFURAN	1970	FOSETYL-AL	225	PYRETHRINS	50
CARBOXIN	919	GLYPHOSATE	5601	RESMETHRIN	10
CHLORAMBEN	137	HEXAZINONE	1300	SETHOXYDIM	431
CHLORINE	20	IMAZALIL	10	SIMAZINE	9366
CHLOROPICRIN	9838	IPRODIONE	4192	STREPTOMYCIN	200
CHLOROTHALONIL	7153	ISOXABEN	715	SULFUR	11092
CHLORPYRIFOS	14614	KINOPRENE	10	TERBACIL	501
CHLORPYRIFOS-METHYL	735	LACTOFEN	62	THIOBENDAZOLE	100
CHLORSULFURON	36	LIME SULFUR	16140	THIOPHANATE-METHYL	1203
CIPC	604	MALATHION	3003	THIRAM	1298
CLOPYRALID	135	MALEIC HYDRAZIDE	933	TRIADIMEFON	315
COPPER	58212	MANCOZEB	3077	TRIADIMENOL	197
COPPER + LIME	1500	MANEB	2434	TRIALLATE	11727
DCPA	1870	MCPA	19880	TRIBENURON	185
DIAZINON	3796	METALAXYL	1838	TRICHLORFON	11500
DICAMBA	2461	METALDEHYDE	3012	TRIFLUMIZOLE	65
DICHLOBENIL	2975	METAM SODIUM	1040	TRIFLURALIN	1889
DICLOFOP	12165	METHAMIDOPHOS	10	TRIFORINE	153
DICOFOL	1004	METHOMYL	57	TURBUFOS	46
DIENOCHLOR	130	METHOXYCHLOR	38	VERNOLATE	392
DIFENZOQUAT	1344	METHYL BROMIDE	33165	VINCLOZOLIN	5794
DIMETHOATE	1064	METOLACHLOR	6093	ZIRAM	160
DINOCAP	350	METRIBUZIN	4402		
DIPHENAMID	889	MEVINPHOS	97		

Jenkins 1999

In 1997, ODEQ and the EPA took sediment samples within the Portland Harbor. The results of the study indicated that sediments in the harbor, including those within the project area, contain concentrations of metals, polychorinated biphenyls (PCBs), pesticides, herbicides, dioxins/furans, tributyltin (TBT), and polycyclic aromatic hydrocarbons (PAHs) above EPA contaminant guidelines. Cleanup of the contaminated sediments is presently being addressed under the Federal Superfund process. In addition, the skeletal deformities in fish upstream from Willamette Falls suggests that there may also be chemical contamination upstream from the Portland Harbor area.

The Willamette River, from its mouth to Willamette Falls, is a free-flowing river. Historically, Willamette Falls was impassable to fall Chinook salmon, coho salmon, chum salmon, and cutthroat trout. However, steelhead and some spring Chinook salmon were known to ascend the falls. Fish passage facilities were constructed at the falls in the early 1900s, and were upgraded in 1971, but passage facilities are inefficient and delay upstream migration.

Habitat conditions within the lower Willamette River are highly degraded. The streambanks have been channelized, off-channel areas removed, tributaries put into pipes, and the river was disconnected from its floodplain as the lower valley was urbanized. Silt loading to the lower Willamette River increased over historic levels due to logging, agriculture, road building, and urban and suburban development within the watershed. The river in the vicinity of Terminal 4 has a soft bottom, with little or no aquatic vegetation. Limited opportunity exits for large wood recruitment to the lower Willamette River due to the paucity of mature trees along the shoreline, and the lack of relief along the shoreline to catch and hold the material. The banks of the river in the action area are heavily industrialized, with much of the bank hardened with riprap, vertical concrete walls, and docking facilities. Much of the historic off-channel habitat has been lost due to diking and filling of connected channels and wetlands. Columbia Slough, downstream from Terminal 4, is the closest remaining off-channel habitat. Connections between the slough and the Columbia River have been cut off, and dikes constructed along much of the slough.

The main channel of the lower Willamette River in the action area is approximately 1,250 feet wide, and varies in depth from 30 to 75 feet. The side of the main channel are steeply sloped due to dredging. The Corps maintains a 40-foot deep navigation channel in Portland Harbor, from the mouth of the river to RM 12.0. Shallow water habitat (less than 20 feet deep) is limited to narrow strips along the shoreline.

The environmental baseline within the action area for the proposed project has been further degraded by human activity. This area contains large industrial shipping facilities, including berths and dense roadways. There is some riparian vegetation present in the project area, but habitat function and erosion control would be increased with more planting in the riparian area. The industrialization of this area contributes to the degraded condition of the Willamette River through reduced water quality, increased water temperature, altered timing and quantity of runoff, and decreased riparian cover and habitat refugia.

The Willamette River downstream from Willamette Falls, is used primarily as a migratory corridor by anadromous salmonids. Based on current research by Oregon Department of Fish and Wildlife (ODFW), rearing of juvenile salmonids occurs in the Portland Harbor.

The Columbia Slough

The Columbia Slough discharges to the Willamette River near Kelley Point Park and the confluence of the Columbia and Willamette Rivers. The lower slough is accessible to salmonids via the Willamette River and splits at river mile (RM) 1.5 into the north slough and the mainstem. The mainstem of the slough is accessible until RM 8.2, where a levee and pump station prevent further access (Ellis 2001). The Columbia Slough is tidal riverine habitat used by salmonids for migration and rearing.

Originally, the slough was a series of wetlands and marshes; it is now a highly-managed water system with dikes and pumps to provide watershed drainage and flood control for the lowlands surrounding it (ODEQ 1998). The slough is listed on the ODEQ 303(d) list as water quality limited for: Bacteria, phosphorus, pH, dissolved oxygen, chlorophyll and temperature (ODEQ 1998). According to Ellis (2001), the Columbia Slough is not functioning properly for several watershed conditions: water quality, access, habitat elements, channel conditions, and hydrology.

Channelization of the Columbia Slough reduced the complexity of the habitat features and the connectivity with adjacent wetlands and sloughs. Refugia for migrating salmonids is present but not abundant (Ellis 2001). There is some large woody debris (LWD) present in the slough, but no comprehensive study had been done when the BA was written. Lack of LWD and refugia reduces the cover available to juvenile salmonids.

The riparian vegetation in the slough at the project site has been modified over the years by levee and dike construction and commercial and industrial development. According to Ellis (2001), the riparian area consists mostly of mature cottonwoods and no conifers. The cottonwoods along the bank provide some stabilization, but up to 10% of the bank is eroding. Within the lower slough, most of the riparian areas are connected and dominated by cottonwood with red-osier dogwood, Himalayan blackberry and Pacific willow (Ellis 2001). Disturbance in the watershed continues with road expansion and water management in this system (Ellis 2001).

2.1.4 Analysis of Effects

In step 3 of NOAA Fisheries' analysis, we identify and evaluate the potential effects of the proposed action on the listed species with consideration of the existing environmental baseline in the action area, including whether the proposed action contributes to, or maintains, a degraded baseline condition.

The application of compounds in proximity to lakes and river systems can result in the transport of potentially toxic chemicals (active ingredients and/or adjuvants) to surface waters (USGS

1999). Such actions constitute a chemical modification of salmon habitat, and they have the potential to harm listed fish. Similar to physical forms of habitat modification (*i.e.,* activities that increase sedimentation, increase water temperatures, or reduce the volume of water in streams), chemical habitat modification can adversely affect salmon via pathways that are both indirect and direct.

Effects to stream habitat and fish populations can be separated into direct and indirect effects. In terms of indirect effects, herbicides can impair the essential biological requirements of salmon if they undermine the physical, chemical, or biological processes that collectively support a productive aquatic ecosystem (Preston, 2002). Changes in specific habitat features, localized reductions in habitat quality such as reduced prey-base, shelter, and cover, ultimately cause loss or reduction of populations of fish due to indirect effects. Direct effects are those that contribute to the immediate loss or harm of individual fish or embryos that are immediately related to herbicide application. The direct effects of herbicides are a concern if they significantly impair the physiological or behavioral performance of salmonids in ways that will reduce growth and survival, migratory success, or reproduction.

To evaluate the risk of harm, effects analyses for herbicides should proceed according to the following logical sequence:

- Expected environmental concentrations and persistence.
- Evidence that the herbicide will enter salmon habitat.
- Evidence for impacts to the aquatic food chain (indirect effects).
- Evidence for impacts on salmon health (direct effects).

This analysis of effects will address the above concerns, beginning with a discussion of what is known about the inert ingredients used with these herbicides, followed by a discussion of glyphosate and triclopyr environmental fate and toxicity. Then the vectors of exposure, and direct and indirect effects on salmonid habitat shall be discussed.

2.1.4.1 Adjuvants

In addition to effects of active ingredient toxicity, inert ingredient toxicity is frequently overlooked and is often little studied or understood. Inert ingredients in pesticides are neither chemically, biologically, or toxicologically inert, and are added to active ingredients to make the pesticide more potent or easier to use. Numerous solvents, surfactants, and carriers are examples of “inert” ingredients that are also contained in pesticide formulations, many of which are toxic to aquatic species (Stark & Walthall, 2003), and applied in watersheds. Frequently used surfactants are nonylphenol polyethoxylates, alkylbenzene sulfonate, polyethoxylated alkyl amines, and others. Toxic solvents include kerosene, naphthalene, cyclohexanone, ethylbenzene, xylene, a variety or oils, and other compounds. Inert ingredients are generally inclusive of adjuvants and solvents, but may include other additives as well. The proprietary nature of many pesticide formulations can make analyzing pesticide formulation toxicity mechanisms difficult due to undisclosed ingredients.

In some cases, the pesticide active ingredient may be less toxic to aquatic species than the "inert" ingredients. The herbicide glyphosate provides a classic example. The LC_{50} values for rainbow trout range for technical grade glyphosate range from 86 milligrams per liter (mg/L) to 140 mg/L (EPA, 1993). However, LC_{50} values for rainbow trout to glyposate formulations range from 8.2 mg/L to >1000 mg/L (EPA, 1993), depending on the adjuvants (inerts that are added to the pesticide upon application) and surfactants added.

Effects of surfactants to aquatic species and herbicide mobility have received some study. In general, it appears that aquatic species are more susceptible to adverse effects from surfactants than terrestrial species. At least some of the aquatic sensitivity to surfactants is due to irritation of gill membranes and alteration of their permeability and molecular exchange properties. Adjuvants can include the following.

1. <u>Surfactants</u> (surface-active ingredients). These are substances that improve the emulsifying, dispersing, spreading wetting, or other surface-modifying properties of liquids. Surfactants include emulsifying agents, crop oils, concentrates, and stickers.

2. <u>Emulsifying Agents</u>. An emulsion is a mixture of two incompletely mixed liquids, one of which is dispersed in the other. Emulsifying agents work to promote the suspension of one liquid in the other. In herbicides, there are two types of emulsions: "Oil-in-water" emulsion, in which the spray mixture in similar to water, and "water-in-oil" emulsion, a rather viscous spray, also called "invert" emulsions. The "oil-in-water" emulsions are widely used in the formulation of herbicides to aid in getting an oil-soluble herbicide dispersed in a water mixture so that the active ingredient may be applied as a water spray. Inert emulsions are used to aid in drift control, to improve resistance of the herbicide treatment to the effects of weather (rain), to improve accuracy of delivery of the herbicide, and to enhance herbicide activity.

3. <u>Wetting Agents</u> (spreaders). Spreaders are added to decrease surface tension in a mixture and cause a larger portion of each spray droplet to come in contact with surface of the plant. The goal is to increase coverage and effectiveness, although it may also alter herbicide selectivity. There are four spreader types: (1) Anionic, which has a negative electrical charge in water; (2) cationic, which has a positive electrical charge in water; (3) nonionic, which does not have an overall electrical charge; and (4) amphoteric, which has positive or negative charges, depending on the pH of the solution.

4. <u>Drift Control Agents</u>. Drift of herbicide sprays can be a problem in some environments. One way to reduce herbicide drift is to increase the droplet size of the spray. Adjuvants that are used to control drift do so in part by reducing the number of fine spray droplets. Thickeners may be used as drift control agents. Crop oil concentrates are products that contain 80 to 85% petroleum or vegetable oil and 14 to 20% surfactant and emulsifiers. An "emulsifiable oil," on the other hand, is a product that contains 98% oil and 1 to 2% emulsifiers. This group is also called "nonphytotoxic oils" and "phytobland oils."

5. Stickers. Adjuvants that cause the herbicide to stick to foliage and prevent any runoff from the target vegetation. The desired result is increased effectiveness.

6. Compatibility Agents. Adjuvants that aid in the suspension of herbicides when they are combined with other pesticides or fertilizers. They are used primarily when the carrier solution is a liquid fertilizer.

7. Acidifiers and Buffers. Acidifiers are acids that neutralize alkaline solutions and lower pH when added to herbicide. Spray solutions of pesticides are the most stable at a slightly acidic pH of 6 or lower. A high pH can cause an accelerated breakdown of the pesticide. Buffers can change the pH of the solution and then maintain it at relatively constant level, even if the water alkalinity changes.

8. Antifoaming Agents and Spray Colorants. An anti-foaming agent eliminates the excess foam that can result when certain herbicide mixtures undergo mixing or agitation in the spray tank. Spray colorants are dyes that can be added to the spray tank so an applicator can see the areas that have been treated.

The use of a nonionic surfactant of either LI-700 or Agri-Dex is required for use with Rodeo® and recommended for Garlon® to promote effectiveness by helping chemicals adhere to the plants, act as a penetrant, act as an anti-foaming agent, and to retard drip and drift. These chemicals are diluted to between 0.5% and 1.5% when mixed with undiluted herbicide. The herbicides themselves will be diluted to between 1% and 2% (1.5% in most cases) when mixed with water.

LI-700 is a nonionic surfactant. According to the EPA Classification of Inert Ingredients in Pesticides, LI-700 is classified as 4A, which means of “minimal concern” and 4B, which means “sufficient information to conclude that current use patterns in pesticide products will not adversely affect public health and the environment” (USFS 1997). The aquatic acute toxicity on the Material Safety Data Sheet for LI-700 indicates that LI-700 has a 24-hour LC50 of 140 mg/L, and a 96-hour LC50 of 130 mg/L for rainbow trout. Agri-Dex is a nonionic oil concentrate with blend of heavy range paraffinic oil as an active ingredient designed for use with a broad range of pesticides. EPA classification of Agri-Dex was not required for this compound.

2.1.4.2 Glyphosate

Glyphosate, an amino acid derivative, is a broad-spectrum, non-selective, systemic herbicide. It is absorbed by the plant’s leaves, moves rapidly through the plant, and acts to prevent production of an essential amino acid for plant growth through inhibition of the shikimate pathway (SERA 2003). This inhibition prevents plants from synthesizing three key aromatic amino acids: phenylalanine, tyrosine, and tryptophan. These enzymes are essential for the normal growth and survival of most plants. This metabolic pathway does not occur in animals, as they do not synthesize phenylalanine and tryptophan, but aquire these essential amino acids through their diet. However, two other biochemical toxic modes of action have been identified: uncoupling of oxidative phosphorylation and inhibition of hepatic mixed function oxidases (SERA 2003). In addition, gyphosate and commonly associated surfactants can damage mucosal tissue at acute concentrations.

Environmental Fate

Glyphosate is strongly adsorbed to most soils, and highly soluble in water. Glyphosate remains unchanged in the soil for varying lengths of time, depending on the soil's texture and organic matter content. Sprankle *et al.* (1975) found that the prime factor in determining the amount of glyphosate adsorbed to soil particles is the soil phosphate level. The half-life of glyphosate in soil can range from 3 to 130 days (EPA 1993, USDA 2001). Soil microorganisms eventually break down glyphosate (Franz *et al.* 1997), while volatilization or photodegradation (photolysis) losses are negligible (Extoxnet website). Although glyphosate has a low propensity for leaching due to high soil adsorbtion, it can enter waterbodies by other means, such as overspray, drift, or erosion of contaminated soil (EPA 1993). Once in water, glyphosate is strongly adsorbed to any suspended organic or mineral matter and is then broken down primarily by microbes. The rate of degredation in water is generally slower than in soil due to the reduced amount of microbial activity (Ghassemi *et al.*1981). Half-lives in pond water range from 12 days to 10 weeks (Extoxnet website).

Evidence from studies suggest that glyphosate levels first rise and then fall to a very low, or even undetectable level, in aquatic systems. After glyphosate was sprayed over two streams in rainy British Columbia, levels in the streams rose dramatically after the first rain event, 27 hours post-application, and fell to undetectable levels 96 hours post-application. The highest glyphosate residues were found in sediments, indicating strong adsorption characteristics of this herbicide. Residues persisted for the entire 171-day monitoring period. It was found that suspended sediment is not a major mechanism for glyphosate transport in rivers (toxnet HSDB website).

Environmental Interactions

The toxicity of glyphosate to aquatic species increases with increasing temperature and pH (SERA 2003). As reported in the Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates (USFWS 1980), glyphosate was twice as toxic to rainbow trout at 17^{O} Celsius than at 7^{O} Celsius. With bluegills, toxicity was twice as toxic at 27^{O} Celsius compared to 17^{O} Celsius. Toxicity was also 2 to 4 times greater to bluegills and rainbow trout at a pH level of 7.5 to 9.5 than at pH 6.5 (pH of 7.0 is considered "neutral water"). However, the EPA (1993) states that glyphosate is stable at pH 3, 6, 9 and at temperatures of 5^{O} and 35^{O} Celsius.

Aquatic Toxicity of Glyphosate

Technical glyphosate acid is slightly toxic to fish, and practically non-toxic to aquatic invertebrate animals (USDA 2001). The EPA classifies glyphosate acid and its salts as "moderately toxic" compounds. However, the presence of inert ingredients may exacerbate its toxicity. Glyphosate acid and its salts are classified as "moderately toxic" compounds by the

EPA. The 96-hour LC50 is 86-140 mg/L in rainbow trout and 120 mg/L in bluegill sunfish. The 48-hour LC50 for glyphosate in daphnia (water flea), an important food source for freshwater fish, is 780 mg/L. The results of a rainbow trout yolk-sac 96-hour LC50 static bioassay yielded results at the 3.4 mg/L level (USGS acute toxicity database website 2004).

There is a very low potential for the compound to build up in the tissues of aquatic invertebrates or other aquatic organisms (toxnet website, USDA 2001). In one study of bioaccumulation and persistence, glyphosate was applied to two hardwood communities in Oregon coastal forest and none of the 10 coho salmon fingerlings analyzed had detectable levels of the herbicide or its metabolite aminomethylphosphonic acid, although levels were detectable in stream water for three days and in sediment throughout the 55-day monitoring period (toxnet website, USDA 2001).

Formulations

Glyphosate is commonly known in several different formulations such as Pondmaster®, Ranger®, Roundup®, Rodeo®, and Touchdown®. Looking at the different formulations, the Accord® and Rodeo® formulations are practically nontoxic to freshwater fish (LC50 = >1,000 parts per million [ppm]) and aquatic invertebrate animals (LC50 = 930 ppm for *Daphnia*). The Roundup® formulation, which contains the surfactant, is moderately to slightly toxic to freshwater fish (LC50 = 5-26 ppm) and aquatic invertebrate animals (LC50 = 4-37 ppm for *Daphnia*). Glyphosate and all of its formulations have not been tested for chronic effects in aquatic animals (USDA 2001).

The EPA conducted surfactant testing for both coldwater and warmwater fish for glyphosate (1993). The application rate used was lower than for technical glyphosate. A formulation of 41.2% isopropylamine salt and 15.3 “AA” surfactant provided a rainbow trout LC50 of 120 mg/L, which is practically nontoxic. Bluegill sunfish experienced similar results, with a LC50 of greater than 180 mg/L. The bluegill and rainbow trout were found to be similar in sensitivity to the glyphosate formulation containing the “W” surfactant, with LC50 values of 150 and >100 mg/L, respectively. Neither rainbow trout (LC50 of 240 mg/L) nor bluebill (LC50 of 830 mg/L) were very sensitive to the x-77 (.5) surfactant and glyphosate (7.03%) (USEPA 1993).

2.1.4.3 Triclopyr

Triclopyr is a pyridine compound used as a selective systemic herbicide for control of woody or broadleaf plants (Extoxnet website). It works by mimicking a natural plant growth hormone, auxin, causing disruption in the growth and viability in susceptible plant species (SERA 2003). It is absorbed by plant surfaces (*e.g.*, green bark, leaves, roots, cut stem surfaces), and moves through the plant, accumulating in the meristem. The mechanism of action in animals is not clearly understood, with the primary affected organ being the kidneys. As with glyphosate, use of triclopyr would reduce vegetation, though triclopyr would not affect grasses, and thus would be less likely to contribute to local soil erosion.

Environmental Fate

There are two commercial formulations of triclopyr: triethylamine TEA salt or butoxyethyl BEE ester (SERA 2003). They both rapidly convert to triclopyr acid/anion, which is highly phytotoxic to plants, and triethanolamine or butoxyethanol (EPA 1998). The major degradate of triclopyr acid/anion in soils and water is 3,5,6-trichloro-2-pyridinol (TCP), which is both persistent, mobile and can be more toxic than the parent compound. TCP has a slightly longer half-life ranging between 30 to 90 days (USDA 2001). TCP is also the major degradation product of chlorpyrifos, an insecticide. TCP eventually converts to CO^2.

Triclopyr is very mobile in soils and not bounded by soil particles (Cox 2000). Triclopyr may leach from light soils if rainfall is very heavy. The persistence of triclopyr in soils is affected by moisture, nutrients, and temperature (Norris *et al.* 1991). An increase in those parameters increases the level of microbial activity which is the major route of triclopyr dissipation in soil. The average half-life in soil is 46 days (USDA 1995). However, residues have been detected for much longer time periods. In Sweden, triclopyr has been found to last more than 2 years in soils (Norris *et al.* 1991).

In water, triclopyr has moderate to low solubility and undergoes degradation by photolysis (USDA 1995). A study in Lake Minnetonka, Minnesota, looked at the aquatic dissipation of triclopyr during the treatment of Eurasian milfoil (Petty *et al.* 1998). Water and sediment samples were collected through six weeks post treatment. Triclopyr and TCP dissipation half-lives in water were 3.7 to 4.7 days, and 4.2 to 7.9 days, respectively. These half lives are substantially shorter than previous studies. However, this is the only study that looked at the direct application of triclopyr to the water (as opposed to the terrestrial landscape). Triclopyr and TCP cleared from animals in <11 days, and <14 days.

Aquatic Toxicology of Triclopyr

Commercial formulations of triclopyr contain either triethylamine TEA salt or butoxyethyl BEE ester (SERA 2003). Triethylamine TEA salt or butoxyethyl BEE ester formulations are different in terms of their hazard potential to aquatic life (SERA 2003). Ecotoxicological research has affirmed that butoxyethyl ester BEE formulations are more toxic to fish, algae, and invertebrates (EPA 1998).

Triclopyr BEE is moderately to highly toxic to freshwater fish on an acute basis, with rainbow trout LC50s ranging from 0.65 to 1.29 ppm and bluegill sunfish LC50s ranging from 0.36 to 1.46 ppm (EPA 1998). The toxicity of triclopyr (butoxyethyl ester) at a concentration lower than 0.56 mg/L reduced spontaneous swimming activity in coho salmon after 96-hour exposures (Johansen and Geen 1990). At concentrations lower than 0.10 mg/L, fish were very sensitive to stimuli. At slightly higher concentrations, they were initially sensitive before reaching a pronounced state of lethargy. It was suggested that the formulation affected the nervous system of the fish.

Triclopyr TEA and triclopyr acid is practically non-toxic to freshwater fish on an acute basis, with rainbow trout LC50s at 240 and 613 ppm and bluegill sunfish LC50sat 471 and 893 ppm (EPA 1998). However, the metabolite of triclopyr, TCP, is more toxic than its original parent compound. This is clearly the case with the triclopyr TEA salt, with acute LC50 values to salmonids in the range of 2 to 10 ppm (Wan 1987 cited in EPA 1998), which is similar to the toxicity of triclopyr BEE.

Aquatic macroinvertebrates are equally or somewhat less sensitive than fish on a acute basis to the various formulations of triclopyr (SERA 2003). Triclopyr TEA is practically non-toxic to aquatic invertebrates on an acute basis, while triclopyr BEE is slightly to moderately toxic to aquatic invertebrates on an acute basis. Available data suggest that the triclopyr degradate, TCP, is slightly toxic to freshwater invertebrates on an acute basis (EPA 1998). These findings suggest that the toxicity of the various formulations of triclopyr to invertebrates mirror that of salmonids.

Formulations

Trade names for herbicides containing triclopyr include Access, Crossbow, ET, Pathfinder® II, Remedy RTU, Garlon® 3a, Garlon® 4, and Forestry Garlon® 4.

Garlon® 3A (Dow AgroSciences) is a formulation made up of triclopyr triethylamine (TEA) salt (44.4%) and inert ingredients (55.6%) and requires the use of a nonionic surfactant. The majority of the inert ingredients (98.2%) have not been identified by the manufacturer. Those inert ingredients that have been identified, water, emulsifiers, surfactants, and ethanol, comprise approximately 1% of the formulation. However, toxicological testing of the Garlon® 3A formulation, including the unidentified ingredients, has been performed.

Garlon® 3A is described as low in toxicity to fish with a 96-hour LC50 of 463 ppm (SERA 1996, p. 4-18) (Table 2). This reflects the toxicity of the formulation, and does not consider typical spray application solutions that recommend the use of additional surfactants. Juvenile coho salmon (0+ presmolt) exposed to Garlon® 3A (200 or 320 ppm) for a 4-hour period were found to have significantly ($P<0.05$) elevated plasma lactate levels in blood samples, which may be an indicator of acute physiological stress (Janz *et al.* 1991). However, corroboratory evidence was not found in that other relevant indicators were not significantly elevated. The authors found "juvenile coho salmon were not severely stressed" by the 4-hour Garlon® 3A exposure, although they acknowledged that wild coho salmon stocks may display "more extreme" stress responses than the subject hatchery specimens (Janz *et al.* 1991). Bioconcentration in aquatic species is minimal (SERA 1996).

Garlon® 3A is highly soluble in water and has characteristics conducive to leaching (*i.e.*, low adsorption potential) (USFS 2001). Several studies have documented triclopyr entry into streams (Norris *et al.* 1991), however, a laboratory study found "little likelihood that triclopyr will leach from forest applications sites into water" (Norris *et al.* 1991). Forest and pasture field studies have similarly found "little indication that triclopyr will leach substantially" in loamy soils (USFS 2001). Photolysis appears to be the major degradation process in natural waters (Norris *et al.* 1991) with the degradation product being oxamic acid and other non-chlorinated aliphatics (SERA 1996). Field tests show that the half-life for triclopyr in water exposed to sunlight ranges from 3 hours to 4.3 days (USFS 2001, Norris *et al.* 1991). In sterile water, which generates a different degradation product, and in the absence of sunlight, triclopyr has a half-life of approximately 3 months (SERA 1996). No information is available for the triclopyr's half-life in darkness in natural waters.

2.1.4.4 Vectors of Exposure

Aquatic biota may be directly exposed to herbicides where they are applied directly to stream channels. However, risks of contamination can be reduced if adequate no-spray buffers are maintained (Heady and Child 1994). The risk is further reduced by use of hand application techniques, as opposed to aerial application, and adherence to conservation measures that minimize the risk of drift or exposure resulting from spill events. However, as Spence *et al*. (1996) state, "toxic levels of chemicals may reach streams from storm runoff and wind drift even when best management practices are employed." Indirect exposure vectors may result from surface and subsurface transport.

Invasive species management, including the use of herbicides, is normally conducted in accordance with best management practices (BMPs). These BMPs are intended, in part, to ensure that water quality and stream habitat is not put at risk. In the area of herbicide application, this is done by attempting to provide adequate controls of the sources of herbicide such that contact with waterbodies is limited. The variety of sources include atmospheric deposition, spray drift, surface water runoff, groundwater contamination and intrusion, and direct application. In addition, timing and patterns of herbicide use determine the ability to limit the risk to water contact.

Environmental fate models have not been run on the two herbicides, triclopyr and glyphosate, to determine their persistence in the environment. Microbial action appears to be the primary factor in the degradation of glyphosate whereas photolysis is the primary degradation mechanism for triclopyr in both soil and aquatic environments. They are considered moderately persistent in the soil, but persistence is dependent on many variables. Chemical formulations, amount of organic material, soil type, temperatures, soil depth, rainfall amounts, pH, water content, and oxygen content all play a role in determining soil persistence. An environment containing dry soil with low microbial presence and receives periodic, high-intensity rainfall events, will be very susceptible to both leaching and surface runoff of glyphosate. This will also be true to a lesser extent with triclopyr.

Waterborne Delivery

There are three primary scenarios of how pesticides could reach the stream channel due to the proposed action:

1. Drift from chemical spray. This period of concern lasts on the order of hours, usually until the chemical has been allowed to dry on foliar surfaces.

2. Runoff from the fields to which spray is applied. This period also lasts on the scale of several hours, during which time the rain flowing over foliar and soil surfaces collects the most available chemical residues (either dissolved or associated with fine particulate).

3. Potential spills in and near stream channels. These scenarios have the potential to transport chemicals to waterways, which will convey them downstream to salmonid habitat.

The adsorption potential, stability, solubility, and toxicity of a chemical determines the extent to which it will migrate and adversely effect surface waters and groundwater (Spence *et al.* 1996).

Chemical Drift

Drift occurring immediately after application is just one way in which exposure to non-target species may occur outside the application area. Drift is dependent on gravity, air movement, and droplet size.[2] Smaller droplets stay aloft longer and the longer a droplet is suspended, the greater the potential for it to be translocated by air currents. A droplet size of 100 microns (mist) takes 11 seconds to fall 10 feet in still air. The same size droplet would travel 13.4 feet in a 1 mph wind while dropping that same 10 feet, and 77 feet at 5 mph.[2] Application pressure, nozzle size, nozzle type, spray angle, and spray volume are all factors in determining droplet size. Droplet sizes increase with decreasing pressure and larger nozzle sizes. An indicated droplet size (*i.e.*, 300 microns) actually represents a median diameter of all droplets. Actual droplet sizes will range from considerably smaller as well as larger than the indicated droplet size. During temperature inversions little vertical air mixing occurs and drift can translocate contaminates several miles. In addition, low relative humidity and/or high temperature conditions will increase evaporation and the potential for drift. Proposed buffers, application criteria, and concurrent drift monitoring should minimize this risk. Application during calm conditions would minimize spray drift.

Runoff

Unintentional transport of pesticides from areas of application to water can be a combined function of many factors. The chemical and physical properties of the pesticide, such as solubility in water and affinity to soil particles, can determine the rate and method of transport. Chemicals that adsorb well to the soil will tend to be immobilized and broken down in place as opposed to highly soluble chemicals that could be washed away via soil surface or subsurface movement with irrigation or rainwater, and would more likely be a potential contaminant.

[2] NebGuide website at <http://www.ianr.unl.edu/pubs/pesticides/g1001.htm

Variations in temporal patterns of elevated pesticide concentrations can also be attributed to a seasonal rise in precipitation during the months of October through March, when about 70 to 80% of the annual rainfall occurs in the Willamette River basin (Wentz 1998). Significant rain events can increase erosion of soils with absorbed pesticides or flush of the more soluble compounds.

Accidental Spills

Accidental spills of pesticides are always a potential risk for aquatic life. Spills near any water would be avoided through siting the mixing and loading zones strategically in the compound area. These BMPs, combined with an adequate spill prevention plan, should avoid the scenario of spill delivery of pesticides to surface waters.

2.1.4.5 Direct Effects of Proposed Action

NOAA Fisheries defines harm as "an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns including breeding, spawning, rearing, migrating, feeding or sheltering" (50 CFR 222.102). The behavioral patterns, and their underlying physiological processes, are measured at the scale of individual animals, and are essential for the viability and genetic integrity of wild populations. It is important to note that many toxicological endpoints or biomarkers may not have clear implications for the health or performance of individual fish (*e.g.* a small percentage change in the activity of a certain enzyme, an increase in oxygen consumption, the formation of pre-neoplastic hepatic lesions). For these kinds of data, it may not be possible to infer a significant loss of function at higher scales of biological complexity.

The toxicological endpoints generally considered to be important for the fitness of salmonids and other fish species include: (1) Direct mortality at any life history stage; (2) an increase or decrease in growth; (3) changes in reproductive behavior; (4) a reduction in the number of eggs produced, fertilized, or hatched; (5) developmental abnormalities, including behavioral deficits or physical deformities; (6) reduced ability to osmoregulate or adapt to salinity gradients; (7) reduced ability to tolerate shifts in other environmental variables (*e.g.* temperature or increased stress); (8) an increased susceptibility to disease; (9) an increased susceptibility to predation; and (10) changes in migratory behavior.

An analysis of the direct impacts of herbicides on salmonids should relate the site-specific exposure conditions (*i.e.,* expected environmental concentration, bioavailability, and exposure duration) to the known or suspected impacts of the chemical on the health of exposed fish. Where possible, such analyses should consider: (1) The life history stage and any associated vulnerabilities of the exposed salmonid; (2) the known or suspected mechanism of toxicity for the active ingredient or adjuvant in question; (3) local environmental conditions that may modify the relative toxicity of the contaminant; and (4) the possibility of additive or synergistic interactions with other chemicals that may enter surface waters as a result of parallel or upstream land use activities.

The majority of existing data on herbicide effects on listed species pertain to acute mortality, and leave open the question the likelihood of harm that might occur from sublethal effects for which no test results have been reported, such as changes in spontaneous swimming activity, swimming capacity, feeding and spawning behavior, or vulnerability to predation (Little *et al.* 1990, and Weis *et al.* 2001). An uncertain level of risk exists from the use of pesticides that have not been thoroughly screened, because, as previously mentioned, sublethal effects, in particular, can occur at concentrations several orders of magnitude below concentrations where lethal effects begin to appear.

Given the results reported in the literature, environmental fate profiles, and limitations of existing BMPs, it appears very likely that herbicides and their degradates will enter salmon habitat as a result of the proposed action. The applicant is proposing to use the herbicides to control invasive plants directly within the riparian area, thus increasing the risk of spray drift or direct application to salmon habitat. Chemical residues, post application, will be mobilized by precipitation. This is especially the case for triclopyr, which is highly mobile in soil and very water soluble. These herbicides also have a very short path of travel. In some areas, like the Leadbetter Peninsula, flooding will bring the water directly to the pesticide.

However, when used according to the EPA label restrictions, it is unlikely that the herbicides or their degradates will be present in receiving waterways at sufficient concentrations to cause direct lethal effects. Direct mortality is not expected. Therefore, for ESA-listed salmonids, the majority of harmful effects are expected to be from sublethal exposure. Sublethal exposures to herbicides could interfere with physiological or behavioral systems that are essential for fish survival, resulting in a potential threat to ESA-listed species. However, protective measures and limitations on herbicide usage incorporated into the proposed action will reduce the likelihood of significant sublethal effects.

2.1.4.6 Indirect Effects of Proposed Action

Herbicides can impair the essential biological requirements of salmon if they undermine the physical, chemical, or biological processes that collectively support a productive aquatic ecosystem (Preston 2002). The alteration of watershed characteristics by herbicides can include disruption of the growth of riparian deciduous vegetation, increased aquatic solar radiation, elevated stream temperatures, and reduced prey base (Spence *et al.* 1986). The loss of riparian vegetation may also decrease the amount of organic litter and large wood delivered to streams. Furthermore, bank instability may result from the loss of vegetation root structure potentially resulting in alteration of hydrologic and sediment delivery processes

The effects of chemical herbicide use frequently extends beyond the intended target species. Herbicide composition, including inert ingredients, carrier agents, surfactants, chemical character, environmental conditions, and application techniques, are among the parameters that determine the degree to which herbicide effects will impact non-target species and their ecosystems. Scientific studies have documented lethal effects, and to a lesser degree, sublethal effects, of herbicide ingredients on many species. These studies are typically laboratory-derived and findings may vary greatly. Conditions in the field may exhibit a greater variability in toxicity (Henry *et al*. 1994) with pre-existing conditions ameliorating effects in some instances and amplifying effects in others. Sublethal effects on fish may include reduced growth, decreased reproductive success, altered behavior, and reduced resistance to stress (Spence *et al*. 1996).

In many cases, however, there is a significant level of uncertainty regarding the direct and indirect effects of herbicides on NOAA Fisheries trust resources. Hoagland *et al.* (1996) identifed key uncertainties regarding herbicides in the following areas: (1) The importance of environmental modifying factors such as light, temperature, pH, and nutrients; (2) interactive effects of herbicides where they occur as mixtures; (3) indirect community-level effects; (4) specific modes of action; (5) mechanisms of community and species recovery; and (6) mechanisms of tolerance by some taxa to some chemicals.

Moreover, based on the data available, herbicides have a high potential to elicit significant effects on aquatic microorganisms at environmentally relevant concentrations (DeLorenzo *et al.* 2001). The application of herbicides can affect the productivity of the stream by altering the composition of benthic algal communities, the food source of macro-invertebrates, at concentrations in the low parts per billion (Hoagland *et al.* 1996). Benthic algae are important primary producers in aquatic habitats, and are thought to be the principal source of energy in many mid-sized streams (Minshall, 1978; Vannote *et al.* 1980; Murphy, 1998). Herbicides can directly kill algal populations at acute levels or indirectly promote algal production by increasing solar radiation reaching streams by disruption of riparian vegetative growth. As mentioned previously, the disruption of riparian vegetative growth carries with it other adverse consequences for salmonid habitat, such as loss of shade, bank destabilization, and sediment control.

The potential effects of herbicides on prey species for salmon are an important concern. Juvenile Pacific salmon feed on a diverse array of aquatic macroinvertebrates (*i.e.* larger than 595 microns in their later instars or mature forms (Cederholm *et al.* 2000). Terrestrial insects, aquatic insects, and crustaceans comprise the large majority of the diets of fry and parr in all salmon species (Higgs *et al.* 1995). Prominent taxonomic groups include *Chironomidae* (midges), *Ephemeroptera* (mayflies), *Plecoptera* (stoneflies), *Tricoptera* (caddisflies), and *Simuliidae* (blackfly larvae) as well as amphipods, harpacticoid copepods, and daphniids. *Chironomids* in particular are an important component of the diet of nearly all freshwater salmon fry (Higgs *et al.* 1995). In general, insects and crustaceans are more acutely sensitive to the toxic effects of environmental contaminants than fish or other vertebrates. However, with a few exceptions (*e.g.* daphniids), the impacts of pesticides on salmonid prey taxa have not been widely investigated. Where acute toxicity for salmonid prey species are available, however, they should be used to estimate the potential impacts of herbicide applications on the aquatic food chain.

The growth of salmonids in freshwater systems is largely determined by the availability of prey (Chapman 1966, Mundie 1974). For example, supplementation studies (*e.g.,* Mason 1976) have shown a clear relationship between food abundance and the growth rate and biomass yield or productivity of juveniles in streams. Therefore, herbicide applications that kill or otherwise reduce the abundance of macroinvertebrates in streams can also reduce the energetic efficiency for growth in salmonids. Less food can also induce density-dependent effects; for example, competition among foragers can be expected to increase as prey resources are reduced (Ricker 1976).

These considerations are important because juvenile growth is a critical determinant of freshwater and marine survival (Higgs *et al.* 1995). For example, a recent study on size-selective mortality in Chinook salmon from the Snake River found that naturally-reared wild fish did not return to spawn if they were below a certain size threshold when they migrated to the ocean (Zabel and Williams 2002). There are two primary reasons why mortality is higher among smaller salmonids. First, fish that have a slower rate of growth suffer size-selective predation during their first year in the marine environment (Parker 1971, Healy 1982, Holtby *et al.* 1990). Growth-related mortality occurs late in the first marine year and may determine, in part, the strength of the year class (Beamish and Mahnken 2001). Second, salmon that grow more slowly may be more vulnerable to starvation or exhaustion (Sogard 1997).

Herbicide applications have the potential to impair autochthonous production and, by extension, undermine the trophic support for stream ecosystems resulting in an adverse effect for salmonids and their associated habitat. The integrity of the aquatic food chain is an essential biological requirement for salmonids, and the possibility that herbicide applications will alter the productivity and watershed characteristics of streams and rivers exist. Therefore, herbicides can potentially impact the structure of aquatic communities at concentrations that fall well below the threshold for direct impairment in salmonids.

In the proposed action, aquatic communities are reasonably certain to be adversely affected by herbicide applications due to drift or runoff. However the degree of impact on non-target prey species depends largely on the intensity, duration, and frequency of the herbicide applications. These factors will determine the rate at which the insects will re-colonize the affected areas. Limited application frequency (three major applications a season) and low amounts of herbicide (0.4 lbs a.i. per acre applied) will result in a short-term, local decrease in non-target aquatic insect populations. Insect and algal populations would be expected to quickly repopulate from upstream areas, limiting the adverse effects to listed salmonid habitats.

2.1.5 Cumulative Effects

Cumulative effects are defined in 50 CFR 402.02 as "those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation." Other activities within the watershed have the potential to impact fish and habitat within the action area. Future Federal actions, including the ongoing operation of hydropower systems, hatcheries, fisheries, and certain land management activities are being (or have been) reviewed through separate section 7 consultation processes with a variety of Federal action agencies.

Within this Opinion, cumulative effects have been analyzed from the context of future pesticide use and pollutant discharges and other water quality degradation to surface waters from non-Federal land use. Such land uses include urban and suburban, commercial forestry and agriculture. While general land use is known, the details of pesticide and fertilizer application amounts and acres treated are not well documented

NOAA Fisheries believes that baseline conditions within much of the action area will be subject to local changes in the short and long term. Until substantial improvements in non-federal land management practices are actually implemented and shown to be effective for enhanced productivity of listed salmonid habitats, NOAA Fisheries assumes that future private and state actions will continue at similar intensities as in recent years.

Other types of agricultural and industrial land uses incorporate pesticides into their land management, though the timing, quantities and frequency of applications are unknown at this time. As noted in Table 2, pesticides and adjuvants are already present in the Willamette River within the action area. The number of pesticides present most likely increases in the downstream direction, as cumulative agricultural land use increases.

The combination of heat and other stress factors can compromise salmonid immune system function (Hardie *et al*. 1994; McCullough, 1999), putting them at an increased susceptibility to disease. Likewise, exposure to environmental pollutants can decrease tolerance to temperature extremes (Paladino *et al*. 1980). Sub-cellular and molecular changes such as enzyme induction are known to precede observable individual or population level effects (Boon *et al*. 1992). The exposure of salmonids to a pesticide can cause effects via physiological pathways specific to the compound of concern, or in combination with other compounds and/or environmental factors.

Given the known water quality stressors (high summer water temperatures and low dissolved oxygen) facing rearing ESA-listed salmonids in the Willamette River and Colombia Slough, and the very likely, but unquantified, presence of pesticides from upstream applications, any additional exposure to toxic compounds is very likely to adversely affect fish rearing in the area affected by the proposed project. However, the adverse reaction is expected to be a minor, localized, short-term degradation of anadromous salmon habitat due to herbicides affecting primary production and aquatic macroinvertebrates.

2.1.6 Conclusion

After reviewing the best available scientific and commercial information regarding the biological requirements and the status of the SR sockeye salmon (*Oncorhynchus nerka*), SR fall Chinook salmon (*O. tshawytscha*), SR spring/summer Chinook salmon, UCR spring-run Chinook salmon, LCR Chinook salmon, UWR Chinook salmon, Columbia River chum salmon (*O. keta*), SR steelhead (*O. mykiss*), UCR steelhead, Middle Columbia River steelhead, UWR steelhead, LCR steelhead, or LCR coho salmon, (*Onchorynchus kisutch*) (a species proposed for listing as threatened under the ESA) considered in this Opinion, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, NOAA Fisheries' concludes that the action, as proposed, is not likely to jeopardize the continued existence of these species, and is not likely to destroy or adversely modify designated critical habitat.

NOAA Fisheries believes that the proposed action would cause a minor, localized, short-term degradation of anadromous salmon habitat due to herbicides affecting primary production and aquatic macroinvertebrates. Direct mortality is not expected. Furthermore, as the new riparian vegetation matures over time, it will contribute to the improvement of habitat functions, including microclimate, erosion control, and shelter for salmonids.

These conclusions are based on the following considerations: (1) A relatively low amount of herbicides are to be applied; (2) the application of chemicals will be timed to coincide with weather conditions that are least likely to result in riparian and aquatic contamination; (3) 25-foot buffer zone for application of Garlon®; (4) herbicides will be applied using precise methodology designed to reduce the amount of pesticide loss; (5) least toxic formulations of herbicides (dilute active ingredient) and surfactants will be used.

2.1.7 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Conservation recommendations are discretionary measures suggested to minimize or avoid adverse effects of a proposed action on listed species or to develop additional information. NOAA Fisheries believes the following conservation recommendations are consistent with these obligations, and therefore should be carried out by the Corps.

1. To minimize the amount of chemical herbicides used beside streams, the Corps should work to develop effective non-chemical treatments to control invasive plants.

2. To minimize the use of chemical herbicides in the future, the Corps should develop a watershed-based prevention and control strategy for invasive plants in cooperation with non-federal land owners, and particular consideration for Dawson and Holland's (1999) recommendations for invasive plant control.

3. The Corps should enhance riparian functions along the Willamette River and Colombia Slough through native plantings. Enhanced riparian areas could reduce risk of drift discharges and increase shade along these two waterways, effectively lowering temperature and providing refugia.

For NOAA Fisheries to be kept informed of actions minimizing or avoiding adverse effects, or those that benefit listed species or their habitats, we request notification of the achievement of any conservation recommendations.

2.1.8 Reinitiation of Consultation

Reinitiation of formal consultation is required and shall be requested by the Federal agency or by the Service, where discretionary Federal involvement or control over the action has been retained or is authorized by law and: (a) If the amount or extent of taking specified in the incidental take statement is exceeded; (b) If new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (c) If the identified action is subsequently modified in a manner that has an effect to the listed species or critical habitat that was not considered in the Opinion; or (d) If a new species is listed or critical habitat designated that may be affected by the identified action (50 CFR 402.16).

2.2 Incidental Take Statement

Section 9(a)(1) and protective regulations adopted pursuant to section 4(d) of the ESA prohibit the taking of listed species without a specific permit or exemption. Among other things, an action that harasses, wounds, or kills an individual of a listed species or harms a species by altering habitat in a way that significantly impairs its essential behavioral patterns is a taking (50 CFR 222.102). Incidental take refers to takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(o)(2) exempts any taking that meets the terms and conditions of a written incidental take statement from the taking prohibition.

2.2.1 Amount or Extent of Take

NOAA Fisheries anticipates that the proposed action covered by this Opinion is reasonably certain to result in incidental take of ESA-listed species due to herbicide contamination of the proposed action area, as defined on page 4. The extent of take is limited to harm caused by three scheduled spot-spray applications per year, using up to 0.044 pounds of glyphosate or triclopyr per acre, per application cycle. Active ingredients will be diluted with water to a concentration of 1-2%, mixed with 0.5-1.5% LI-700 or Agri-Dex surfactants. Scheduled applications will be made using a combination of low-pressure backpack spray equipment and wick techniques. Limited applications to target noxious species or vegetation missed during scheduled area-wide applications may also be completed as necessary. Any take resulting from herbicide applications that do not follow these project design features, including the formula, timing, location, and application methods analyzed in this Opinion, or that extends beyond the action area, is not part of the amount or extent of incidental taking specified in this incidental take statement.

This incidental take statement does not become effective for LCR coho salmon until NOAA Fisheries adopts the conference opinion as a biological opinion, after the listing is final. Until the time that LCR coho salmon is listed, the prohibitions of the ESA do not apply.

2.2.2 Reasonable and Prudent Measures

Reasonable and prudent measures are non-discretionary measures to minimize take, that are not already part of the description of the proposed action. They must be implemented as binding conditions for the exemption in section 7(a)(2) to apply. The Corps has the continuing duty to regulate the activities covered in this incidental take statement. If the Corps fails to require contractors to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the contract, or fails to retain the oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse. NOAA Fisheries believes that activities carried out in a manner consistent with these reasonable and prudent measures will not necessitate further site-specific consultation. Activities carried out which do not comply with the reasonable and prudent measures are not covered by this Opinion and will require further consultation.

NOAA Fisheries believes that based on: (1) The lack of sound and reliable scientific data on sublethal effects to salmon and steelhead from exposure to herbicides; (2) the uncertainty of BMP effectiveness; and (3) the presence of salmon and steelhead (incubating eggs, juveniles, adults) in the action area during herbicide applications, the following reasonable and prudent measures are necessary and appropriate to minimize incidental take of listed species resulting from implementation of the proposed action. These reasonable and prudent measures will also minimize adverse effects on designated critical habitat.

The Corps shall:

1. Minimize the extent of incidental take associated with herbicide application by implementing BMPs that minimize the movement of herbicides to surface and surface-ground water mixing zones.

2. Monitor the effectiveness of BMPs, conservation recommendations, and terms and conditions designed to minimize incidental take, and report the results to NOAA Fisheries.

2.2.3 Terms and Conditions

To be exempt from the prohibitions of section 9 of the Act, Corps must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

1. To implement reasonable and prudent measure #1 (minimize the movement of herbicides to surface and surface-ground water mixing zones), the Corps shall ensure that:

    a. All BMPs described in section 1.2.1 of this Opinion are implemented.
    b. Spill response procedures have been developed and reviewed with each applicator before commencing herbicide application operations.

c. All chemical storage, chemical mixing, and post-application equipment cleaning is completed in a confined area to prevent the potential contamination of any RHCA, perennial or intermittent waterbody, unprotected ephemeral waterway, or wetland.
d. Use only those sprayers with a single nozzle, such as back pack or hand sprayers, to spray herbicides in the riparian zone.
e. All hand operated application equipment is leak and spill proof.
f. Herbicide applications are prohibited when precipitation is occurring or forecast to occur within the next 24 hours, or if windspeeds are over 5 miles per hour.
g. A licensed/certified herbicide applicator is conducting all spray projects.
h. Only the minimum area necessary for the control of noxious weeds is treated.
i. All equipment used for transportation, storage, or application of chemicals be maintained in an area that is constructed to fully contain all chemicals, and not loaded or unloaded within 300 feet of any perennial or intermittent stream or waterbody.
j. Garlon® would not be applied to wetland sites or within 25-feet of waterbodies or on Leadbetter Peninsula, which, at high water has a direct connection with Bybee Lake.
k. Rodeo® would only be applied to those sites with close proximity to water, and wetlands.
l. All herbicides shall be diluted no less than a maximum concentration of 1.5%.
m. A maximum of 3 major treatments may occur per year, with limited spot spraying occurring between treatments.

2. To implement reasonable and prudent measure #2 (monitoring), the Corps shall ensure that:

a. Non-target plant mortality in riparian areas will be monitored to ascertain if mortality of non-target plants is affecting riparian function.
b. After treatment each year, provide NOAA Fisheries with a list of the following information for each location treated:
    i. Acres treated
    ii. Riparian acres treated
    iii. Application method
    iv. Herbicide used (including concentration, rate of application per acre treated and total amount used for all treatments)
    v. Date of treatment, weather
    vi. Name of applicator
    vii. Report of accidents, if any.
c. Monitoring results will be reported to NOAA Fisheries (Dan Gambetta 503.231.2243) after the field season and before weed control activities if similar activities are proposed in subsequent years.
d. If a listed species specimen is found dead, sick, or injured, as a possible result of the proposed action or other unnatural cause, initial notification should be made

to the NOAA Fisheries Law Enforcement Office, Vancouver Field Office, 600 Maritime, Suite 130, Vancouver, Washington 98661; telephone: 360/418-4246. Care should be taken in handling sick or injured specimens to ensure effective treatment and care or the handling of dead specimens to preserve biological material in the best possible state for later analysis of cause of death. In conjunction with the care of sick or injured endangered and threatened species or preservation of biological materials from a dead animal, the finder has the responsibility to carry out instructions provided by Law Enforcement to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

e. Monitoring reports will be submitted to:

National Marine Fisheries Service
Oregon Habitat Branch
Attn: 2004/00238 or 2004/00423
525 NE Oregon Street
Portland, OR 97232

3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

3.1 Background

The MSA, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-297), requires the inclusion of EFH descriptions in Federal fishery management plans. In addition, the MSA requires Federal agencies to consult with NOAA Fisheries on activities that may adversely affect EFH.

EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA §3). For the purpose of interpreting the definition of EFH: "Waters" include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle (50CFR600.110).

Section 305(b) of the MSA (16 U.S.C. 1855(b)) requires that:

- Federal agencies must consult with NOAA Fisheries on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH;

- NOAA Fisheries shall provide conservation recommendations for any Federal or state activity that may adversely affect EFH;

- Federal agencies shall within 30 days after receiving conservation recommendations from NOAA Fisheries provide a detailed response in writing to NOAA Fisheries regarding the conservation recommendations. The response shall include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the conservation recommendations of NOAA Fisheries, the Federal agency shall explain its reasons for not following the recommendations.

The MSA requires consultation for all actions that may adversely affect EFH, and does not distinguish between actions within EFH and actions outside EFH. Any reasonable attempt to encourage the conservation of EFH must take into account actions that occur outside EFH, such as upstream and upslope activities, that may have an adverse effect on EFH. Therefore, EFH consultation with NOAA Fisheries is required by Federal agencies undertaking, permitting or funding activities that may adversely affect EFH, regardless of its location.

3.2 Identification of EFH

The Pacific Fisheries Management Council (PFMC) has designated EFH for federally-managed fisheries within the waters of Washington, Oregon, and California. The designated EFH for groundfish and coastal pelagic species encompasses all waters from the mean high water line, and upriver extent of saltwater intrusion in river mouths, along the coasts of Washington, Oregon and California, seaward to the boundary of the U.S. exclusive economic zone (370.4 km) (PFMC 1998a, 1998b). Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other waterbodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream from certain impassable, man-made barriers (as identified by the PFMC), and longstanding, naturally-impassable barriers (*i.e.*, natural waterfalls in existence for several hundred years) (PFMC 1999). In estuarine and marine areas, designated salmon EFH extends from the nearshore and tidal submerged environments within state territorial waters out to the full extent of the exclusive economic zone (370.4 km) offshore of Washington, Oregon, and California north of Point Conception to the Canadian border.

Detailed descriptions and identifications of EFH for the groundfish species are found in the Final Environmental Assessment/Regulatory Impact Review for Amendment 11 to *The Pacific Coast Groundfish Management Plan* (PFMC 1998a) and the *NOAA Fisheries Essential Fish Habitat for West Coast Groundfish Appendix* (Casillas *et al.* 1998). Detailed descriptions and identifications of EFH for the coastal pelagic species are found in Amendment 8 to the *Coastal Pelagic Species Fishery Management Plan* (PFMC 1998b). Detailed descriptions and identifications of EFH for salmon are found in Appendix A to Amendment 14 to the *Pacific Coast Salmon Plan* (PFMC 1999). Assessment of the potential adverse effects to these species' EFH from the proposed action is based on this information.

3.3 Proposed Actions

The proposed action is detailed above in section 1.2. This area has been designated as EFH for various life stages of Chinook and coho salmon and starry flounder (*Platyichthys stellatus*).

3.4 Effects of Proposed Action

As described in detail in the ESA portion of this consultation, the proposed activities may result in detrimental, short-term, adverse effects to water quality. However, over the long term as native shrubs, trees and grasses become established, it is anticipated that water quality (temperature, sediment/turbidity) and other habitat parameters will improve.

3.5 Conclusion

NOAA Fisheries believes that the proposed action may adversely affect the EFH for Chinook salmon, coho salmon, and starry flounder.

3.6 EFH Conservation Recommendations

Pursuant to section 305(b)(4)(A) of the MSA, NOAA Fisheries is required to provide EFH conservation recommendations for any Federal or state agency action that would adversely affect EFH. The conservation measures proposed for the project by the Corps and all of the terms and conditions contained in sections 2.2 (except those regarding disposition of individual specimens of listed species injured or killed by the proposed action) are applicable to EFH. Therefore, NOAA Fisheries incorporates each of those measures here as EFH conservation recommendations.

3.7 Statutory Response Requirement

Please note that the MSA (section 305(b)) and 50 CFR 600.920(j) requires the Federal agency to provide a written response to NOAA Fisheries after receiving EFH conservation recommendations within 30 days of its receipt of this letter. This response must include a description of measures proposed by the agency to avoid, minimize, mitigate or offset the adverse impacts of the activity on EFH. If the response is inconsistent with a conservation recommendation from NOAA Fisheries, the agency must explain its reasons for not following the recommendation.

3.8 Supplemental Consultation

The Corps must reinitiate EFH consultation with NOAA Fisheries if the action is substantially revised or new information becomes available that affects the basis for NOAA Fisheries' EFH conservation recommendations (50 CFR 600.920).

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